

CLAIMS

WHAT IS CLAIMED IS:

1. An injection molding apparatus comprising;
a nozzle having a nozzle channel;
a mold cavity in communication with the nozzle channel of the nozzle for receiving a melt stream of moldable material from the nozzle channel through a mold gate; and
a valve pin axially movable through the nozzle channel of the nozzle between a first retracted position in which the valve pin closes the mold gate to block melt flow between the nozzle channel and the mold cavity, an extended position in which an end portion of the valve pin extends through the mold gate and into the mold cavity, and a third retracted position in which the end portion of the nozzle pin is withdrawn from the mold cavity into the nozzle and spaced apart from the mold gate thereby opening the mold gate,
the end portion of the valve pin defining a melt flow path on an outer surface thereof that extends through the mold gate when the valve pin is in the extended position for transmitting the melt stream from the nozzle channel to the mold cavity when the valve pin is in the extended position.
2. The injection molding apparatus of claim 1 wherein the melt flow path on the outer surface of the valve pin is formed by a groove provided on the outer surface.
3. The injection molding apparatus of claim 2, further comprising a second groove provided in the outer surface of said valve pin, said second groove being located opposite the groove, the second groove extending through the mold gate when the valve pin is in the extended position for transmitting the melt stream from the nozzle channel to the mold cavity.

4. The injection molding apparatus of claim 3, wherein said groove and said second groove intersect to provide an aperture through said valve pin.

5. The injection molding apparatus of claim 1 wherein in said first retracted position and in said extended position and as the valve pin is moved therebetween, at least a portion of the outer surface of the valve pin is in continuous contact with the mold gate for aligning the valve pin with the mold gate.

6. The injection molding apparatus of claim 1 wherein the outer surface on which the melt flow path is defined has a smooth profile for facilitating the flow of the melt stream from the nozzle channel to the mold cavity.

7. The injection molding apparatus of claim 1 wherein the melt flow path is provided by a spiral groove formed on the outer surface of the valve pin.

8. A method of injecting a melt stream of moldable material into a mold cavity of an injection molding apparatus having a nozzle with a nozzle channel in communication with the mold cavity through a mold gate, and a valve pin mounted for axial movement through the nozzle channel relative to the mold gate between at least a first position in which the valve pin closes the mold gate, a second position in which the valve pin directs a melt stream through the mold gate and into the mold cavity in a first direction, and a third position in which the melt stream is directed through the mold gate in a second direction, the method including:

delivering a melt stream of moldable material into the nozzle channel of the nozzle;

moving the valve pin to the second position and directing the melt stream through the mold gate and into the mold cavity in the first direction;

moving the valve pin to the third position and directing the melt stream through the mold gate and into the mold cavity in the second direction; and

moving the valve pin the first position to close the mold gate.

9. The method of claim 8 wherein the first direction is substantially transverse to the second direction.
10. The method of claim 8 wherein in the second position an end of the valve pin that defines a melt flow path extends through the mold gate, the melt flow path directing the melt stream from the nozzle channel to the melt channel through the mold gate in the first direction.
11. The method of claim 10 wherein in the third position the end of the valve pin is retracted into the nozzle channel and spaced apart from the mold gate.
12. The method of claim 11 wherein in the first position the valve pin engages and blocks the mold gate.
13. The method of claim 12 wherein the step of moving the valve pin to the second position includes moving the valve pin from the first position to the second position.
14. The method of claim 13 wherein the step of moving the valve pin to the first position includes moving the valve pin from the third position to the first position.
15. The method of claim 8 wherein the steps are performed in the order stated and further including, prior to moving the valve pin to the second position, a step of moving the valve pin from the first position to the third position and directing the melt stream into the mold cavity in the second direction.
16. The method as claimed in claim 8, wherein at least a portion of an outer surface of said valve pin is in continuous engagement with the mold gate to align said valve pin relative to the mold gate when the valve pin is moved between.

the first and second positions.

17. An injection molding apparatus comprising:

a manifold and a nozzle, the manifold having a manifold channel for receiving a melt stream of moldable material under pressure and delivering the melt stream to a nozzle channel of the nozzle;

a mold cavity in communication with the nozzle channel of the nozzle for receiving melt through a mold gate;

a valve pin axially movable through the nozzle channel of the nozzle between a first retracted position, in which a forward end of the valve pin is seated in the mold gate to block melt flow between the nozzle channel and the mold cavity, an extended position, in which a portion of the valve pin is received in the mold cavity, and a second retracted position in which the forward end of the valve pin is retracted within the nozzle channel and spaced apart from the mold gate to allow melt flow between the nozzle channel and the mold cavity; and

a material feeding portion provided in a guiding surface of the valve pin, wherein in the extended position, the material feeding portion is aligned with the mold gate to allow melt to flow between the nozzle channel and the mold cavity.

18. The injection molding apparatus as claimed in claim 17, wherein the material feeding portion has a smooth profile to facilitate the flow of melt from the nozzle channel to the mold cavity.

19. The injection molding apparatus as claimed in claim 17, wherein the material feeding portion includes a groove provided in the guiding surface of the valve pin.

20. The injection molding apparatus as claimed in claim 12, wherein said material feeding portion is a pair of opposing grooves provided in said guiding surface of said valve pin.